Claims

1. Piezoceramic multilayer actuator (10) with alternating internal electrodes led to the surface of the actuator (11; 30 to 37; 39, 40) and inactive regions (15) assigned to them, with the internal electrodes of the same polarity being connected by their contact surfaces (17) to form a parallel circuit to the external electrode (24) in each case, and the external electrodes (24) being arranged on opposing sides of the actuator (10), characterised in that the contact surfaces (17), and therefore the inactive regions (15) assigned to them of one or a predetermined number of internal electrodes of the same polarity (11; 30 to 37; 39; 40), arranged above one another in the same direction, are arranged offset to one another by a predetermined angle (22) of the value α with respect to the contact surfaces (17), and therefore the inactive regions (15) assigned to these, of the preceding internal electrode or a predetermined number of preceding same-polarity internal electrodes of the same alignment.

2. Piezoceramic multilayer actuator according to Claim 1, characterised in that the offset (41) is of such a size, as a multiple of the predetermined angle (22), according to a predetermined height (38), and therefore a predetermined number of layers (23), consisting of a layer of piezoceramic material (25) with internal electrodes (11) located thereon, that at least the contact surfaces (17) of the first (39) and the last (40) of the internal electrodes of the same polarity (11) in this range (38) no longer overlap.

3. Piezoceramic multilayer actuator according to Claim 1, characterised in that the offset (41), as a multiple of the predetermined angle (22), according to a region of a predetermined height (38) and therefore of a predetermined number of layers (23), consisting of a layer of piezoceramic material (25) with an internal electrode (11) located thereon, is so large that the inactive regions (15) of the first (39) and the last (40) of the internal electrodes of the same polarity (11) in this region (38) no longer overlap.

4. Piezoceramic multilayer actuator according to one of Claims 1 to 3, characterised in that the offset (41) is determined in a region (38) of from about 0.5 mm to about 3 mm, corresponding to some 5 to 30 layers (23), which in each case consist of the piezoceramic material (25) and the internal electrode (11) located thereon.

5. Piezoceramic multilayer actuator according to Claim 4, characterised in that the offset (41) is determined in a region (38) of from about 1 mm to about 1.5 mm, corresponding to some 10 to 15 layers (23).

6. Piezoceramic multilayer actuator according to one of Claims 1 to 5, characterised in that an offset (41) is provided several times in succession in a multilayer actuator (10), depending on its size.

7. Piezoceramic multilayer actuator according to Claim 6, characterised in that the offset (41) is reversed in the opposite direction in each case after the completion of one region or several regions (38), so that a wave-shaped run of the offsets is produced.

8. Piezoceramic multilayer actuator according to one of Claims 1 to 7, characterised in that the actuator (10) has a circular cross-section (12).

9. Piezoceramic multilayer actuator according to Claim 8, characterised in that, the external electrodes (24) have a helical run at the connection of the contact surfaces (17) of internal electrodes with the same polarity (11; 30 to 37; 39, 40) with a constant running offset (41) of the contact surfaces (17).

10. Piezoceramic multilayer actuator according to one of Claims 1 to 7, characterised in that its cross-section surface is a square, a rectangle, or a polygon.

11. Piezoceramic multilayer actuator according to Claim 10, characterised in that an external electrode runs over one side surface or, in particular in the case of a polygonal cross-section, over several side surfaces.

12. Piezoceramic multilayer actuator according to one of Claims 1 to 11, characterised in that it has a through borehole (27) along its longitudinal axis (26).

13. Piezoceramic multilayer actuator according to one of Claims 1 to 11, characterised in that pocket holes are provided at its ends.

14. Piezoceramic multilayer actuator according to one of Claims 1 to 13, characterised in that in the head region (28) and in the foot region (29) of the actuator (10) the internal electrode spacing (30 to 33 and 34 to 37 respectively) increases from electrode to electrode towards the respective end (28 or 29) of the actuator (10).

15. Piezoceramic multilayer actuator according to one of Claims 1 to 14, characterised in that the actuator (10) is a constituent part for the control of an injection valve.

16. Method for the manufacture of a multilayer actuator according to one of Claims 1 to 15, characterised in that several internal electrodes of the same polarity, with co-aligned contacting surfaces for the external electrode, are located in each case on a green film made of a piezoceramic material, in that, in order to obtain the offset of the contact surfaces, the internal electrodes of the same polarity are located on the subsequent green film with the respective offset in each case generated by a predetermined angle α to the position of the preceding electrode, in that the corresponding internal electrodes of opposing polarity are located on the green films rotated through 180 degrees in each case, in that the green films of opposing polarity are then laid on top of one another to form a block, with the contact surfaces, and therefore the assigned inactive regions of one or of a predetermined number of electrodes of the same polarity, arranged above one another in the same direction, being arranged offset to one another by the predetermined angle α opposite the contact surfaces, and therefore the assigned inactive regions of the preceding internal electrode or a predetermined number of preceding electrodes of the same alignment and same polarity, and in that the actuators are then prepared from this block.

17. Method for the manufacture of a multilayer actuator according to Claim 16, characterised in that the processing for shaping a multilayer actuator in the green state is conducted prior to sintering.

18. Method for the manufacture of a multilayer actuator according to Claim 16, characterised in that the processing for shaping a multilayer actuator is carried out subsequent to sintering.

19. Method for the manufacture of a multilayer actuator according to one of Claims 16 to 18, characterised in that, subsequent to the sintering of the actuator, the sinter skin is left on its surface, and only ground are the regions for exposing the electrodes, at which the contact surfaces of the internal electrodes are connected to the external electrode .